Message

**From**: Callaghan, Todd (ENV) [todd.callaghan@state.ma.us]
**Sent**: 4/26/2017 7:24:17 PM
**To**: Colarusso, Phil [colarusso.phil@epa.gov]; Stover, Toby [Stover.Toby@epa.gov]
**Subject**: RE: draft email

Phil

Those are good points about looking at the combined effects of DO with temp and heavy metals; one could probably also throw in nitrogen and pH but we'd have to have studies that look at those as well as DO. I'm not sure if anyone had been thinking of combined effects in this approach.

Just to reiterate, I think there is still a lot of work to do. Tetra Tech's disclaimer on its worksheet is "Do Not Cite or Quote." What I sent to the group was some work on acute values. I probably should have started with chronic values. And maybe this is my fault for starting in on some analysis before we have all of the raw data in hand. Tetra Tech did crib chronic DO values from the Virginian Province Approach, which are:

mud crab 4.67 mg/l
spider crab 4.67 mg/l
lobster 4.47 mg/l
summer flounder 3.97 mg/l

The approach uses the average of the top four most sensitive taxa for the standard (in the case above, it would be 4.45 mg/l). We still haven't decided what the time periods of interest are. I'm not sure what DEP's comfort level is with finely grained time-steps such as 1 hour, a few days per season, 1 week, 1 month, etc. Some of the DO standards from other states that we've been looking at as models look to me to be really difficult to assess in reality. I cannot imagine that anyone is going to have the staff time to gather and analyze DO data on a one-hour or one-day time frame.

I think if you could forward Lesa Meng's work and anything else you have on DO, it would be helpful.

Todd

PS I'll see you tomorrow at 8:30. My cell is 617-776-9409.

---

**From:** Colarusso, Phil [mailto:colarusso.phil@epa.gov]
**Sent:** Wednesday, April 26, 2017 3:05 PM
**To:** Stover, Toby; Callaghan, Todd (EEA)
**Subject:** draft email

Toby, Todd,

Here's a draft of the email I'm planning on sending to the DO group. Plus, review and let me know where I might be off base.

Thanks
Phil

Folks,

I apologize for my late entry into this process. A significant family health issue has been rightfully keeping me busy. Thus, I have been playing catchup with the large number of emails that have flown back and forth on this. In all honesty, I can't say I've read all the details, but I understand the gist of what is trying to be accomplished.

Let me briefly give you some context as to where I am coming from in making comments on this process. As you all are likely familiar, Mount Hope Bay fish populations collapsed in the mid-1980s coincident in time with a 40% expansion of open cycle cooling at Brayton Point Station. After 13 years of scientific debate, legal action and the hard work of many folks from EPA, Mass CZM, Mass DEP, Mass DMF and RI DEM, Dominion decided to install cooling towers at Brayton Point. The cost was estimated by EPA to be $250 million dollars, Dominion tells us the cost was more than twice that. Either way, a substantial financial investment in restoring Mount Hope Bay was made. Cooling towers were built and thermal discharge and cooling water flow was reduced by over 95%. Subsequently, fracking happened and now Brayton Point is poised to close in weeks. Fish populations have not rebounded as hoped. There are several theories of why this may be the case. One of which is that environmental conditions are still of insufficient quality to support sufficient reproduction/survival of specific fish species to fuel a population increase.

From what I have seen in the email traffic to date is that the approach has largely focused on lab studies with mortality endpoints. This is a fine starting point, but I hope that the deliberations will extend far beyond mortality endpoints. I'm assuming that any site specific DO criteria for this area, must not conflict with the narrative criteria of Excellent fish habitat for SA waters and Good fish habitat for SB waters. During the years of analysis of the Brayton permit, we considered the importance of sublethal effects of temperature on growth, and avoidance. We made the case and MA DEP supported us in this approach, that excellent or even good fish habitat is not characterized by areas that fish avoid or have their normal growth stunted. Both of these sublethal effects actually can lead to higher mortality rates. Fish that avoid their normal areas, may face greater exposure to predators. Growth is directly tied to survival in juvenile fish, so reducing normal growth rates increases mortality. This is especially true for species like winter flounder in Mount Hope Bay, who fall prey to shrimp until they outgrow them. Lesa Meng of EPA's Narragansett Lab conducted growth experiments with juvenile winter flounder in Mount Hope Bay and found statistically significantly reduction in growth from controls and attributed it to temperature and DO. She attributed 43% of the reduction to DO concentrations below 4 mg/l. There are numerous other studies also looking at winter flounder growth rates and temperature and dissolved oxygen.

DO does not occur in isolation, water temperature is critical in understanding an organism's physiological state and needs. Is there consideration on setting numeric criteria that somehow take into account water temperature. Additionally, just as a point of consideration, the sediments of Mount Hope Bay are elevated in heavy metals. It is well established in the aquatic toxicology literature the synergistic effect low dissolved oxygen has on the toxicity of many chemicals. Since this effort is intended to produce site specific numbers, shouldn't all of the site specific factors that go into preserving excellent and good fish habitat be factored into that deliberation?

Phil